What is claimed is:

1. An alignment-mark pattern defined on a stencil reticle used in charged-particle-beam microlithography, the alignment-mark pattern being configured to be transferred lithographically by a charged particle beam from the stencil reticle to a sensitized substrate so as to imprint on the substrate a corresponding alignment mark detectable using an optical-based alignment-detection device, the alignment-mark pattern comprising pattern elements defined as respective apertures in the stencil reticle, each of the pattern elements being split into respective pattern-element portions, separated by respective girders formed from a membrane of the stencil reticle, so as to avoid forming membrane islands in the reticle and to prevent stress-based deformation of the pattern elements in the reticle.

2. The alignment-mark pattern of claim 1, wherein the pattern elements include pattern elements defining corresponding alignment-mark elements that intersect each other.

3. The alignment-mark pattern of claim 2, wherein the girders extend across respective pattern elements at regions of intersection of the pattern elements.

4. The alignment-mark pattern of claim 2, wherein the pattern elements include girders that extend across respective pattern elements at regions displaced from regions of intersection.

5. The alignment-mark pattern of claim 1, wherein the pattern elements are non-intersecting with each other.

6. The alignment-mark pattern of claim 5, wherein the pattern elements include a first group that are separate from but oriented perpendicularly to a second group.

7. The alignment-mark pattern of claim 1, wherein each girder defines a corresponding alignment-mark girder, in the corresponding alignment mark, having a width that is no greater than a resolution limit of the optical-based alignment-detection device.

8. A stencil reticle for use in charged-particle-beam microlithography, comprising:

a reticle membrane; and

an alignment-mark pattern comprising multiple pattern elements defined as respective apertures in the reticle membrane, the alignment-mark pattern being configured to be transferred lithographically by a charged particle beam from the stencil reticle to a sensitized substrate so as to imprint on the substrate a corresponding alignment mark that is detectable using an optical-based alignment-detection device, each of the pattern elements on the reticle being split into respective pattern-element portions, separated by respective girders formed from the reticle membrane, so as to avoid forming membrane islands in the reticle and to prevent stress-based deformation of the pattern elements in the reticle.

9. The stencil reticle of claim 8, further defining a device pattern.

10. The stencil reticle of claim 9, wherein the device pattern is defined in a first region of the reticle and the alignment-mark pattern is defined in a second region of the reticle separate from the first region.

11. The stencil reticle of claim 8, wherein the pattern elements include pattern elements that intersect each other.

12. The stencil reticle of claim 11, wherein the girders extend across respective pattern elements at regions of intersection of the corresponding alignment-mark elements.

13. The stencil reticle of claim 11, wherein the pattern elements include girders that extend across respective pattern elements at regions displaced from regions of intersection.

14. The stencil reticle of claim 8, wherein the pattern elements are non-intersecting with each other.

15. The stencil reticle of claim 8, wherein each girder defines a respective alignment-mark girder, in the respective alignment mark, having a width that is no greater than a resolution limit of the optical-based alignment-detection device.

16. The stencil reticle of claim 8, wherein the reticle membrane comprises a charged-particle-scattering material.

17. A stencil reticle, comprising an alignment-mark pattern as recited in claim 1.

18. The stencil reticle of claim 17, configured as a scattering-stencil reticle.

19. A substrate, imprinted with an alignment mark corresponding to the alignment-mark pattern as recited in claim 1.

20. A substrate, imprinted with an alignment mark corresponding to the alignment-mark pattern on the stencil reticle as recited in claim 8.

21. In a microlithographic method, a method for determining an alignment of a lithographic substrate, the method comprising:

on a stencil reticle defining an alignment-mark pattern comprising pattern elements defined as respective apertures in a membrane of the stencil reticle, each of the pattern elements on the reticle being split into respective pattern-element portions, separated by respective girders formed from the membrane, so as to avoid forming membrane islands in the reticle and to prevent stress-based deformation of the pattern elements in the reticle;

lithographically transferring the alignment-mark pattern on the reticle to a sensitized substrate using a charged particle beam so as to imprint the corresponding alignment mark on the substrate; and

detecting the alignment mark on the substrate to determine alignment of the substrate.

22. The method of claim 21, wherein the detecting step is performed using an optical-based alignment-detection device.

23. The method of claim 22, wherein the optical-based alignment-detection device is an FIA-based device.

24. The method of claim 21, wherein, in the defining step, the pattern elements are defined to include pattern elements that intersect each other.

25. The method of claim 24, wherein, in the defining step, the girders are defined so as to extend across respective pattern elements at regions of intersection of the corresponding alignment-mark elements.

26. The method of claim 24, wherein, in the defining step, the pattern elements are defined to include girders that extend across respective pattern elements at regions displaced from regions of intersection of the corresponding alignment-mark elements.

27. The method of claim 21, wherein, in the defining step, the pattern elements are defined so as not to intersect with each other.

28. The method of claim 27, wherein, in the defining step, the pattern elements are defined so as to include a first group of pattern elements that is separate from but oriented perpendicularly to a second group of pattern elements.

29. The method of claim 21, wherein:

the detecting step is performed using an optical-based alignment-detection device; and

in the defining step, each girder is configured to form a corresponding alignment-mark girder, in the corresponding alignment mark, having a width that is no greater than a resolution limit of the optical-based alignment-detection device.

30. In a microlithographic method, a method for determining an alignment of a lithographic substrate, the method comprising:

providing a stencil reticle as recited in claim 8;

lithographically transferring the alignment-mark pattern on the reticle to a sensitized substrate using a charged particle beam so as to imprint the corresponding alignment mark on the substrate; and

detecting the alignment mark on the substrate to determine alignment of the substrate.